

Variations on a Human Face Project

Exploring the inheritance of traits in humans



This is a partner project with a duration of one week, to be presented in a poster format that will show the inheritance of polygenic traits versus Multiple Alleles.

Variations on a Human Face

Question: How are variations of human traits different from Mendel's pea plants?

Materials: a coin, chart on human variations, parent/offspring traits chart

Step 1: You and a partner will explore how inheritance works in humans, particularly with the face. One of you will create a male face, and the other person will create a female face. On the front of the face, you will illustrate how the face looks with colors trying to be as accurate as possible given the traits your face has. On the back, use the chart given to write the genotype and the phenotype of each trait.

Step 2: You and your partner will create 4 offspring. Each person should be responsible for 2 children, which means each person is responsible for 3 faces: 1 adult and 2 children. Use the directions below to guide you through creating your offspring faces.

Creating Offspring

For each trait on the chart, you will flip a coin to determine what GENOTYPE your offspring will have. For all coin tosses: heads will represent the dominant allele and tails will represent the recessive allele. Be sure to write the **genotype** and **phenotype** correctly.

Example: For Shape of Face – Your partner tossed heads, and you tossed tails. That means your offspring's genotype is Rr, and the child will have a round face. You would check that box. If you had both tossed tails, the child would have a square-shaped face (rr). If you'd both tossed heads, the child would have a round shaped (RR) face.

1. You will need a coin. Begin with the gender of your offspring. Flip the coin, if the coin lands heads up, Y gene is inherited, if tails, the X gene is inherited. Since males have an XY Chromosome and females have an XX chromosome, you only have to flip the coin once. The other toss will automatically be a recessive allele, X.

What is the sex of your offspring? _____

Polygenic Traits

Some traits are controlled by more than two genes and are called polygenic. Hair, eye color and skin color are examples of polygenic traits.

Hair Color

Dark hair is dominant over light. To determine the color of the offspring's hair, assume there are two gene pairs involved (there are actually more than that, but for the purpose of this activity, let's not get complicated). You will only determine which genotype your offspring will have based on what is available from the parents. You should not have any genotype that the parents could not pass on.

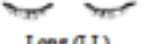






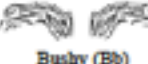











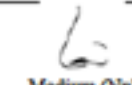































Flip your coin first to determine the genotype of the first pair of alleles (AA, Aa, or aa). Now, flip the coins again to determine the genotype of the second pair of alleles (BB, Bb, or bb). Match the genotype you have to the hair color on the chart. Record your offspring's hair color.

If the genotype is....

AABB
AABb
AAbb
AaBB
Aabb
AaBb
aaBB
aaBb
aabb

The hair color is...

black
black
red
brown
regular blonde
brown
dark blonde
regular blonde
pale yellow blonde

Human Variations				Trait	Dominant (both heads)	Hybrid (one head, one tail)	Recessive (both tails)
Trait	Dominant (both heads)	Hybrid (one head, one tail)	Recessive (both tails)	Length of Eyelashes	 Long (LL)	 Long (Ll)	 Short (ll)
Shape of Face	 Round (RR)	 Round (Rr)	 Square (rr)	Shape of Eyebrows	 Bushy (BB)	 Bushy (Bb)	 Thin (bb)
Cleft in Chin	 Absent (CC)	 Absent (Cc)	 Present (cc)	Position of Eyebrows	 Not connected (NN)	 Not connected (Nn)	 Connected (nn)
Hair	 Curly (HH)	 Wavy (Hh)	 Straight (hh)	Size of Nose	 Large (NN)	 Medium (Nn)	 Small (nn)
Widow's Peak	 Present (WW)	 Present (Ww)	 Absent (ww)	Shape of Lips	 Thick (TT)	 Medium (Tt)	 Thin (tt)
Spacing of Eyes	 Close (EE)	 Normal (Ee)	 Far (ee)	Size of Mouth	 Large (LL)	 Medium (Ll)	 Small (ll)
Shape of Eyes	 Almond (AA)	 Almond (Aa)	 Round (aa)	Size of Ears	 Large (LL)	 Medium (Ll)	 Small (ll)
Position of Eyes	 Straight (SS)	 Straight (Ss)	 Slant (ss)	Freckles	 Present (FF)	 Present (Ff)	 Absent (ff)
Size of eyes	 Large (LL)	 Medium (Ll)	 Small (ll)	Dimples	 Present (DD)	 Present (Dd)	 Absent (dd)

Eye Color

Dark eyes are dominant over light. To determine the color of the offspring's eyes, assume there are two gene pairs involved, one which codes for depositing pigment in the front of the iris, and one which codes for depositing pigment in the back of the iris. You will only determine which genotype your offspring will have based on what is available from the parents. You should not have any genotype that the parents could not pass on.

Determine the genotype of the first pair (AA, Aa, or aa) Then flip again to determine the genotype of the second pair (BB, Bb, or bb).

Use the chart below to find out what eye color your offspring has and record it.

If the genotype is....	The eye color is....
AABB	dark brown
AABb	dark brown
AAbb	brown
AaBB	brown with green flecks
AaBb	brown
Aabb	gray-blue
aaBB	green
aaBb	dark blue
aabb	light blue (hazel)Other facial features

Use the following chart to help you figure out the rest of the facial features for each offspring. Flip a coin for the first allele, and flip the coin again for the second allele if needed. You will only determine which genotype your offspring will have based on what is available from the parents. You should not have any genotype that the parents could not pass on.

For example: Father has short eyelashes (ll) and mother has long eyelashes (LL). Coin flip shows heads, which is L. Second coin flip shows tails, which is l. So offspring has hybrid eyelashes, Ll.

Please circle which face the chart represents. Don't forget to name the face!

■ Parent: Mother Father Name: _____

■ Offspring: 1 2 3 4 Name: _____

Trait	Genotype	Phenotype
Gender		
Eye Color		
Hair Color		
Shape of Face		
Cleft in chin		
Hair		
Widow's Peak		
Spacing of Eyes		
Shape of Eyes		
Position of Eyes		
Size of Eyes		
Length of Eyelashes		
Shape of Eyebrows		
Position of Eyebrows		
Size of Nose		
Shape of Lips		
Size of Mouth		
Size of Ears		
Freckles		
Dimples		

Be sure to match the appropriate genotype and phenotype to what the face looks like.

Step 3: Presenting

You and your partner will present your faces on a poster board no smaller than 14 X 17 inches. You should have the Parent generation on the top and the F1 generation below. You will also present punnett squares to show how the combination of traits were possible. Last, you will present the charts of traits for each face to show the genotypes and phenotypes.

In summary, you will have two parent faces, 4 offspring faces, 6 trait charts, and 20 punnett squares.

Rubric:

2 Parent faces 4 points each ____

6 matching trait charts 6 points each ____

4 Offspring faces 4 points each ____

20 Punnett squares appropriately designed and clearly labeled: 2 points each ____

Total Points (out of 100) ____

Any grade less than 60 is considering a failing grade and will automatically be given a score of 50 points.

This project is due on _____

One-Factor Cross

Write the genotypes of the two organisms that will serve as parents in a cross. In this example we will cross a male and female bird that are heterozygous for large beaks. They each have the genotype of Bb

Bb and Bb

Bb = B & b Bb = B & b

Determine what alleles would be found that each parent could produce.

	B	b
B		
b		

Determine what alleles would be found that each parent could produce. Calculate the percentage of each genotype and phenotype.

	B	b
B	BB	Bb
b	Bb	bb

Two-Factor Cross

In this example we will cross two pea plants that are heterozygous for size (tall and short alleles) and pod color (green and yellow alleles). The genotypes of the two parents are TtGg and TtGg

TtGg and TtGg

TtGg = TG & tG & Tg & tg

TtGg = TG & tG & Tg & tg

Determine what alleles would be found that each parent could produce.

	TG	Tg	tG	tg
TG				
Tg				
tG				
tg				

Determine what alleles would be found that each parent could produce. Calculate the percentage of each genotype and phenotype.

	TG	Tg	tG	tg
TG	TTGG	TTGg	TtGG	TtGg
Tg	TTgG	TTgg	TtGg	Ttgg
tG	TtGG	TtGg	ttGG	ttGg
tg	TtGg	Ttgg	ttGg	ttgg